Speaker: **Mori TAKASHI (RIKEN, Japan)**

Title: **Operator dynamics in bulk-dissipated quantum many-body systems**

Open quantum many-body systems, in which the system of our interest is macroscopic, has attracted much attention in the context of quantum technologies such as the quantum computation and the quantum reservoir engineering. Theoretically, in the Markovian regime, the nonequilibrium dynamics of such a system is described by the quantum master equation of the Lindblad form.

In this talk, after a brief review on the microscopic derivation of the many-body Lindblad equation, I discuss general feature of the dissipative dynamics of local operators under bulk dissipation. In particular, I explain the mechanism of the accelerated decay due to the interplay between the operator growth and the bulk dissipation [1]. I present mathematical conjectures on the accelerated decay, which can be a powerful theoretical tool in analyzing open quantum many-body systems. As an application of the conjectured form of the accelerated decay, I present two results. One is on the spectral gap of the Lindbladian, which is related to the quantum Ruelle-Pollicott resonance [2]. The other one is on an improved error bound on the many-body Lindblad equation [3]. Our new error bound tells us that several approximations (Born, Markov, and so on) needed in deriving the Lindblad equation are justified for an arbitrarily long time evolution of a macroscopic system, as long as the system-bath couplings are sufficiently weak.

[1] Tatsuhiko Shirai and Takashi Mori, Phys. Rev. Lett. 133 040201 (2024).

[2] Takashi Mori, Phys. Rev. B 109 064311 (2024).

[3] Teruhiro Ikeuchi and Takashi Mori, arXiv:2503.14916.